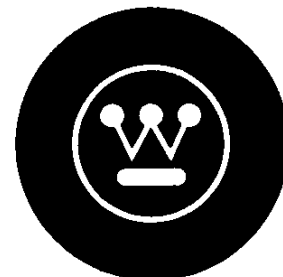


**Instructions for the Selection, Application, and  
Installation of Digitrip RMS 500 Trip Units on  
Westinghouse SPB Power Circuit Breakers  
Equipped with Pow-R-Trip 7 or Digitrip I Trip Units**



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Effective May, 1991

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## Safety Precautions

### WARNING

SPB Power Circuit Breakers are equipped with high speed, high energy operating mechanisms. The breakers and their enclosures are designed with several built-in interlocks and safety features intended to provide safe and proper operating sequences. To provide maximum protection for personnel associated with the installation, operation, and maintenance of these breakers, the following practices must be followed:

- Only qualified persons, as defined in the National Electric Code, who are familiar with the installation and maintenance of power circuit breakers and their associated switchgear assemblies should perform any work associated with these breakers.
- Completely read and understand all instructions before attempting any installation, operation, maintenance, or modification of these breakers.
- **ALWAYS TURN OFF AND LOCK OUT THE POWER SOURCE FEEDING THE BREAKER PRIOR TO ATTEMPTING ANY INSTALLATION, MAINTENANCE, OR MODIFICATION OF THE BREAKER. DO NOT USE THE CIRCUIT BREAKER AS THE SOLE MEANS FOR ISOLATING A HIGH VOLTAGE CIRCUIT.** Follow all lockout and tagging rules of the National Electric Code and all other applicable codes, regulations, and work rules.
- **DO NOT WORK ON A CLOSED BREAKER OR A BREAKER WITH THE CLOSING SPRINGS CHARGED.** Trip (open) the breaker and be sure the stored energy springs are discharged before performing any work. The breaker may trip open or the charging springs may discharge, causing crushing or cutting injuries.
- For drawout breakers, trip (open), and then remove the breaker to a well lighted work area before beginning work.
- Do not perform any maintenance, including breaker charging, closing, tripping, or any other function which could cause a significant movement of the breaker while it is on the extension rails. Doing so may cause the breaker to slip from the rails and fall, potentially causing severe personal injury to those in the vicinity.
- **DO NOT LEAVE THE BREAKER IN AN INTERMEDIATE POSITION IN THE SWITCHGEAR CELL.** Always leave it in the **CONNECTED, TEST, or DISCONNECTED** position. Failure to do so could lead to improper positioning of the breaker and flashover, causing death, serious personal injury and/or property damage.
- **DO NOT DEFEAT ANY SAFETY INTERLOCK. SUCH INTERLOCKS ARE INTENDED TO PROTECT PERSONNEL AND EQUIPMENT FROM DAMAGE DUE TO FLASHOVER AND EXPOSED CONTACTS. DEFLATING AN INTERLOCK WILL LEAD TO DEATH, SEVERE PERSONAL INJURY AND/OR PROPERTY DAMAGE.**

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## Section 1

### Selection and Application of Digitrip RMS 500 SPB Retrofit Components

#### 1-1. SPB Retrofit Application Requirements

The information in this instruction leaflet provides information on how to select, apply, and install the components necessary to retrofit a Westinghouse SPB Power Circuit Breaker equipped with a Pow-R-Trip 7 or Digitrip I Trip Unit with a Digitrip RMS 500 Trip Unit.

The retrofit is based on the following application restrictions and clarifications, which must be addressed by the purchaser prior to the selection of the components:

1. Only SPB Breakers equipped with Pow-R-Trip 7 or Digitrip I Trip Units are retrofittable. SPB Breakers equipped with Pow-R-Trip Trip Units cannot be retrofitted at this time.
2. SPB Breakers installed as automatic transfer switches and equipped with a bell alarm contact cannot be retrofitted at this time.
3. SPB Breakers equipped with a power relay module (ATR) cannot be retrofitted at this time.
4. Ground fault protection cannot be added to the SPB Breaker. The SPB Breaker must be originally equipped with ground fault protection, for ground fault protection to be selected. Changing the ground fault protection from 3 wire to 4 wire is not permitted. Interchanging the protection between LI, LS, and LSI or LIG, LSG, or LSIG is permitted.
5. SPB Breaker equipped with zone interlocking for short-time and/or ground fault time delays can be retrofitted, provided the existing zone interlock configuration is not changed.

#### 1-2. SPB Retrofit Kit Components

The SPB Retrofit is accomplished by the selection and application of 3 basic components; the Digitrip RMS 500 Trip Unit, the Digitrip RMS SPB Adapter Box, and the rating plug.

##### 1. Digitrip RMS 500 Trip Unit

The available Digitrip RMS 500 trip units for selection are listed in Fig. 1-1. Select the trip unit to match the trip functions of the Pow-R-Trip 7 or Digitrip I Trip Unit in the SPB Breaker to be retrofitted.

**Note:** The application restrictions listed in Section 1-1 must be observed.

The Digitrip RMS 500 Trip Unit is a microprocessor-based protective device that provides true RMS sensing means for proper correlation with thermal characteristics on conductors and equipment. Each trip unit has given combinations of adjustable current protective settings for the Long-Time (L), Short-Time (S), Instantaneous (I), and Ground Fault Time (G) Delay trip functions. Short-Time (S) and Ground Fault (G) Delays are equipped with an adjustable setting for a flat or an  $I^2t$  response. The adjustable settings are step-type, expressed in terms of the  $I_n$  (continuous current) rating of the breaker. LEDs provide mode of trip indications for the L, S, I, and G trip functions.

Digitrip RMS/R Trip Units provided without instantaneous protection, i.e., LS or LSG, are equipped with a nonadjustable

discriminator and instantaneous override circuit. An indicating Discriminator/Override LED is provided. The discriminator circuit prevents the circuit breaker from being closed and latched-in on a fault. The nonadjustable discriminator release is preset at 11 times the installed rating plug  $I_n$  rating. The instantaneous override is a nonadjustable high-set circuit that acts to trip the breaker instantaneously when the fault current approaches the short circuit withstand rating of the breaker.

The trip unit is equipped with a male edge-card connector, which plugs into the Digitrip RMS SPB Adaptor Box. A female type receptacle is included to accept the rating plug, which determines the  $I_n$  (continuous current) rating of the breaker. Digitrip RMS Trip Units are equipped with a receptacle to receive the Auxiliary Power Module (APM). The APM is an optional accessory item used to supply power to the trip unit self-test system.

Additional Digitrip RMS 500 Trip Unit features are detailed in I.L. 29-851-A. Characteristic Curves SC-4282-87, SC-4283-87, and SC-4284-87 are provided for application.

##### 2. Digitrip RMS SPB Adapter Box

The available Digitrip RMS SPB Adapter Boxes are listed in Fig. 1-2. Each adapter box includes a fixed value zener diode that establishes the trip unit instantaneous override value for the SPB Breaker to be retrofitted. Select the adapter box style to match the existing SPB Breaker type, current frame rating, and current withstand rating as shown.

The Digitrip RMS SPB Adapter Box extends the depth of the Digitrip RMS Trip Unit so that it matches the depth and mounting configuration of a Pow-R-Trip 7 or Digitrip I Trip Unit. The adapter box accepts the male edge-card connector of the trip unit. Hardware is included to secure the adapter box to the trip unit. The trip unit and adapter box assembly can then be plugged directly into the SPB Breaker.

#### CAUTION

The Digitrip RMS SPB Adapter Box must be matched to the breaker short-time withstand rating as shown in Fig. 1-2. Failure to do so could cause severe injury or death and equipment damage.

The adapter box also permits the installer to match the existing zone interlocking scheme (if any) on the existing SPB Breaker. Two Removable jumpers are included on each adapter box to short out the zone interlock capability of the trip unit. If the SPB Breaker is not applied in a zone interlocking scheme, the jumpers are left intact. If the breaker has an existing zone interlocking scheme, one or both of the jumpers can be removed to match the short delay or ground delay zone interlocking trip functions.

##### 3. Digitrip RMS SPB Rating Plugs

The available Digitrip RMS SPB Rating Plugs are listed in Fig. 1-3. The rating plug plugs into the Digitrip RMS Trip Unit to determine the breaker  $I_n$  (continuous current) rating. Select the rating plug to match the installed current sensor rating and the distribution system frequency, i.e., 50 or 60 hertz.

Each rating plug has fixed  $S_1$  and  $S_2$  values, which correspond to the Short Delay trip unit settings and  $M_1$  and  $M_2$  values, which correspond to the Instantaneous trip unit settings. The rating plug is equipped with a long-life 3.0 Volt lithium type battery. This back-up battery is not used to power the Digitrip RMS overcurrent protective circuit. It maintains the trip mode of trip indication LEDs following a breaker tripping operation. A new battery will maintain the mode of trip LED for approximately 60 hours. The battery is replaceable from the front, without having to remove the rating plug from the trip unit.

If a rating plug is removed when the breaker is in the closed position, the breaker may trip. Therefore, the rating plug must be securely installed, with its screw tightened into the threaded insert existing in the SPB Breaker.

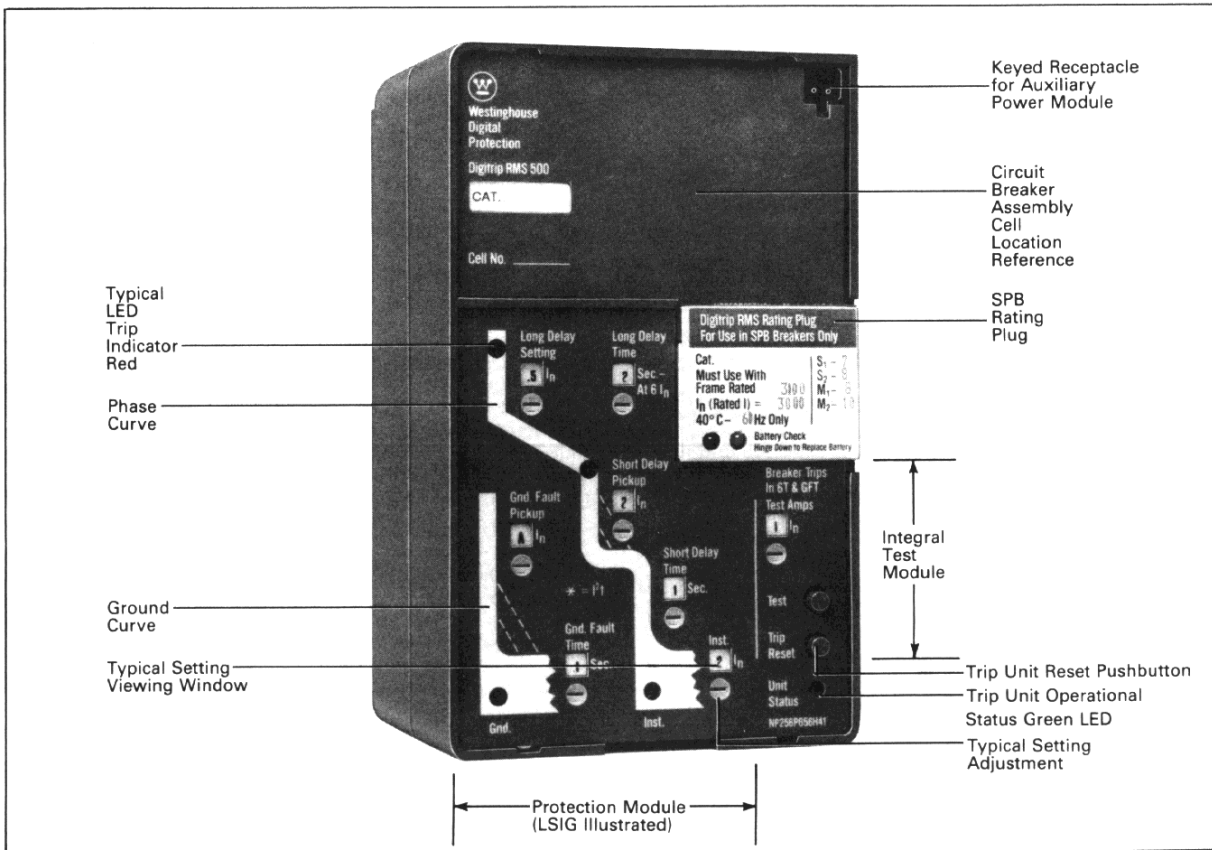
**1-3. Digitrip RMS SPB Retrofit Accessories**

The available Digitrip RMS SPB Retrofit Accessories are listed in Fig. 1-4.

**Fig. 1-1**

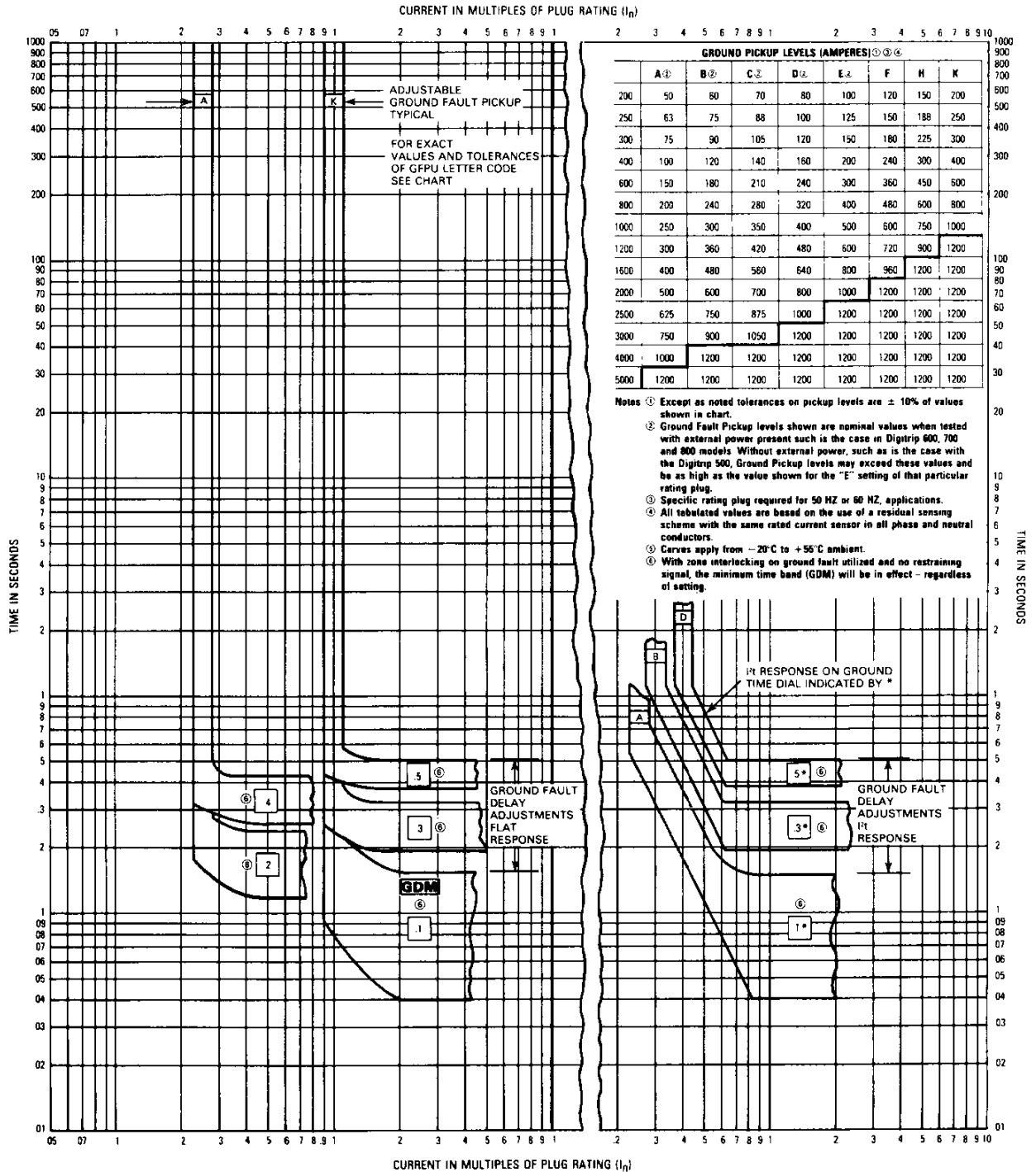
**Digitrip RMS Retrofit Trip Units**

Digitrip RMS Trip Unit Type and Description	Style No.	Functions	Catalog No.
RMS 500 (With or without Zone Interlocking)	1230C97G01	LI	T51BLI
	1230C97G03	LS	T53BLS
	1230C97G02	LSI	T52BLSI
	1230C97G04	LIG	T54BLIG
	1230C97G05	LSG	T55BLSG
	1230C97G06	LSIG	T56BLSIG



**DIGITRIP RMS 500/600/700/800**

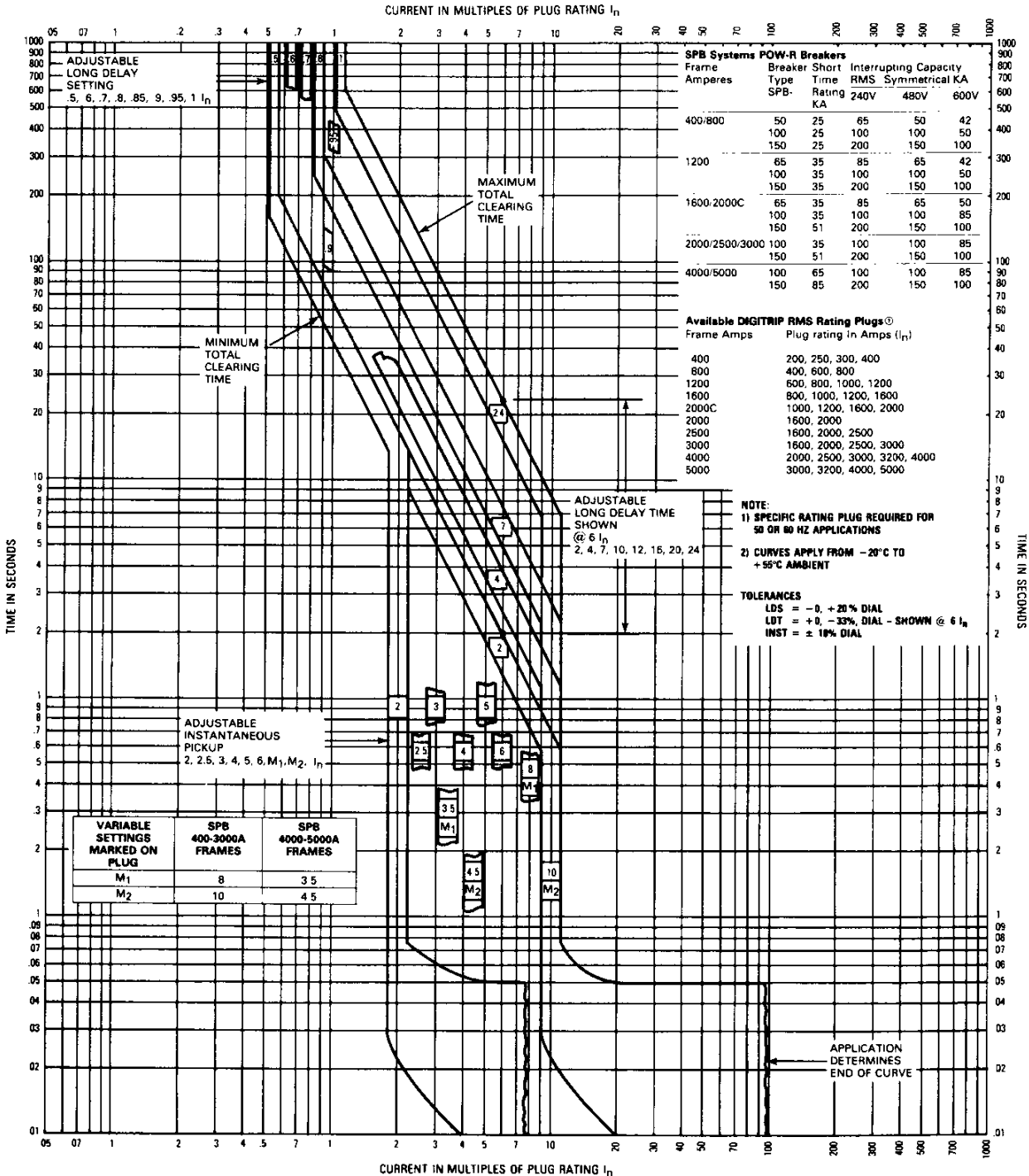
Typical Time-Current Characteristic Curve (G)  
for Type SPB Systems Pow-R Breakers



Long-Time/Instantaneous Time-Current Curve SC-4283-87

**DIGITRIP RMS 500/600/700/800**

Typical Time-Current Characteristic Curve (LI) for Type SPB Systems Pow-R Breakers





**DIGITRIP RMS 500/600/700/800**

**Typical Time-Current Characteristic Curve (LS)  
for Type SPB Systems Pow-R Breakers**

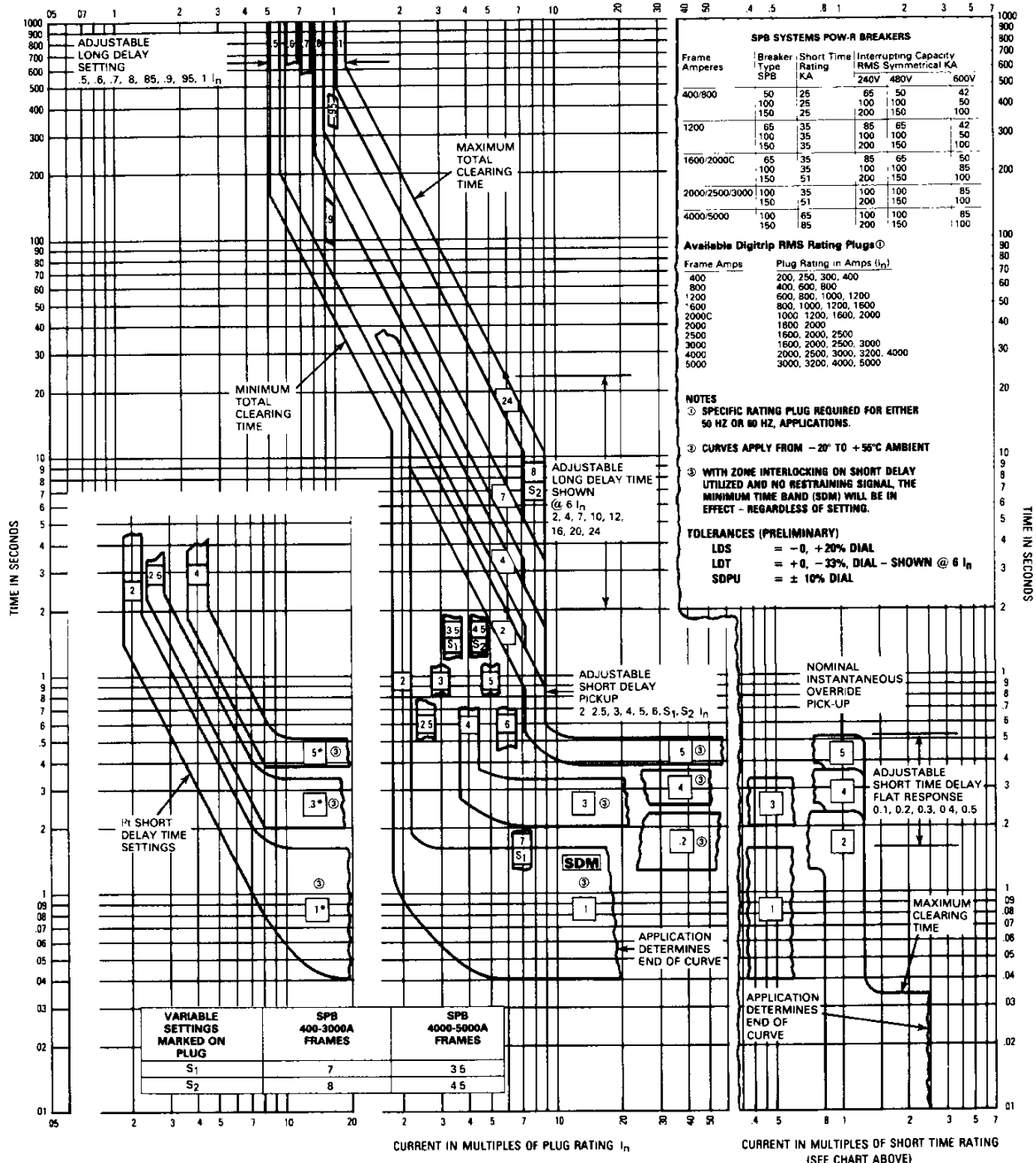
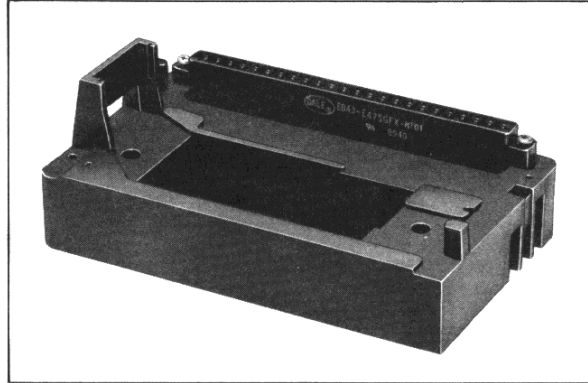


Fig. 1-2

**Digitrip RMS Retrofit Adapter  
Boxes for SPB Breakers**

SPB Breaker	Continuous Current Frame Rating	Short Time Rating With Selective Override	Digitrip RMS Adapter Box Style No.
SPB50	400	25 Ka	1232C94G01
	800	25 Ka	1232C94G02
SPB65	1200	35 Ka	1232C94G03
	1600	35 Ka	1232C94G03
	2000C	35 Ka	1232C94G04
SPB100	400	25 Ka	1232C94G01
	800	25 Ka	1232C94G02
	1200	35 Ka	1232C94G03
	1600	35 Ka	1232C94G03
	2000C	35 Ka	1232C94G04
	2000	35 Ka	1232C94G05
	2500	35 Ka	1232C94G05
	3000	35 Ka	1232C94G05
	4000	65 Ka	1232C94G06
	5000	65 Ka	1232C94G05
SPB150	400	25 Ka	1232C94G01
	800	25 Ka	1232C94G02
	1200	25 Ka	1232C94G03
	1600	51 Ka	1232C94G07
	2000C	51 Ka	1232C94G08
	2000	51 Ka	1232C94G09
	2500	51 Ka	1232C94G09
	3000	51 Ka	1232C94G09
	4000	85 Ka	1232C94G03
	5000	85 Ka	1232C94G04



**Fig. 1-3**

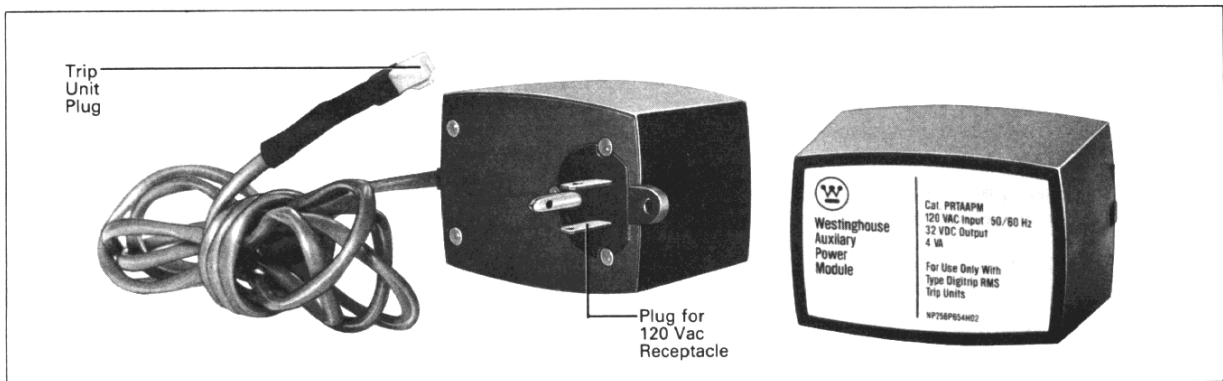
**Digitrip RMS Rating  
Plugs for SPB Breakers**

SPB Breaker Frame Rating (Amps)	Maximum Breaker Continuous Current Rating (Amps I <sub>N</sub> )	SPB Catalog No. (60 Hz)	SPB Catalog No. (50 Hz)
400	200	PD6S04A020	PD5S04A020
	250	PD6S04A025	PD5S04A025
	300	PD6S04A030	PD5S04A030
	400	PD6S04A040	PD5S04A040
800	400	PD6S08A040	PD5S08A040
	600	PD6S08A060	PD5S08A060
	800	PD6S08A080	PD5S08A080
1200	600	PD6S12A060	PD5S12A060
	800	PD6S12A080	PD5S12A080
	1000	PD6S12A100	PD5S12A100
	1200	PD6S12A120	PD5S12A120
1600	800	PD6S16A080	PD5S16A080
	1000	PD6S16A100	PD5S16A100
	1200	PD6S16A120	PD5S16A120
	1600	PD6S16A160	PD5S16A160
2000	1600	PD6S20A160	PD5S20A160
	2000	PD6S20A200	PD5S20A200
2000C	1000	PD6S21A100	PD5S21A100
	1200	PD6S21A120	PD5S21A120
	1600	PD6S21A160	PD5S21A160
	2000	PD6S21A200	PD5S21A200
2500	1600	PD6S25A160	PD5S25A160
	2000	PD6S25A200	PD5S25A200
	2500	PD6S25A250	PD5S25A250
3000	1600	PD6S30A160	PD5S30A160
	2000	PD6S30A200	PD5S30A200
	2500	PD6S30A250	PD5S30A250
	3000	PD6S30A300	PD5S30A300
4000	2000	PD6S40A200	PD5S40A200
	2500	PD6S40A250	PD5S40A250
	3000	PD6S40A300	PD5S40A300
	3200	PD6S40A320	PD5S40A320
	4000	PD6S40A400	PD5S40A400
5000	3000	PD6S50A300	PD5S50A300
	3200	PD6S50A320	PD5S50A320
	4000	PD6S50A400	PD5S50A400
	5000	PD6S50A500	PD5S50A500

**Fig. 1-4**

**Digitrip RMS Accessories  
for SPB Breakers**

Accessory Description	Accessory Style or Catalog No.	Function
Auxiliary Power Module (APM)	PRTAAPM 1267C16G01	Powers Digitrip RMS Trip Unit During Self-Testing
Lithium Battery 3.0 Volt	Varta Batteries, Inc. Model CR 1/3N 150 Clarabrook Road Elmsford, NY 10523  Duracell Model DL 1/3N South Broadway Tangtown, NY 10591 (914)-591-7000  Union Carbide Corp. Battery Products Div. Model 2L-76BP Eveready 39 Old Ridgebury Road Danbury, CT 06817-0001 (203)-794-7548	Powers Digitrip LED Mode of Trip Indicators (Back-up Power)



Auxiliary Power Module

## Section 2

### Installation Instructions

#### WARNING

READ ALL INSTRUCTIONS PROVIDED BEFORE BEGINNING WORK, ESPECIALLY THE SAFETY PRECAUTIONS LISTED AT THE FRONT OF THESE INSTRUCTIONS.

#### 2-1. Preparation Before Retrofit

1. A Digitrip RMS 500 Trip Unit, SPB/Digitrip Adapter Box, and a Digitrip SPB Rating Plug are required to complete this retrofit. These components are subject to the restrictions listed in Section 1 and must coordinate with the breaker ratings. Before beginning the retrofit, check the breaker nameplate information and confirm that the components to be installed are proper for the application.

2. Observe all safety precautions listed at the front of these instructions. Be sure the SPB breaker is in the open position and the stored energy springs are discharged.

#### 2-2. Removal of the Existing Trip Unit and Rating Plug From the Breaker

1. Refer to Fig. 2-1. Remove the breaker manual charging handle by removing the two screws as shown and pull the handle down.

2. Remove the breaker front cover by removing all the cover mounting screws and lifting the cover off the breaker.

3. Remove the rating plug by turning the rating plug screw counterclockwise and pulling the rating plug out of the trip unit.

4. To remove the existing trip unit, lift the upper spring retention clip as shown. After the top clip has been freed, pull out on the trip unit slightly at the top and pry down on the bottom retaining clip. The trip unit can now be pulled out of the plug-in control terminal block.

#### 2-3. Attachment of the SPB Adapter Box to the Digitrip RMS 500 Trip Unit

#### CAUTION

The Digitrip RMS SPB Adapter Box must be matched to the breaker short-time withstand rating as shown in Fig. 1-2. Failure to do so could cause severe injury or death and equipment damage.

1. Remove the 2 screws and star washers at the rear of the Digitrip RMS 500 Trip Unit (in the upper right hand and lower left hand corner).

**Notice:** DO NOT BREAK the Westinghouse factory seal sticker. Doing so will void the trip unit warranty.

2. Refer to Fig. 2-2. Install the 2 inch long threaded spacers in the rear of the trip unit at the location of the removed screws.

3. Plug the adapter box into the rear of the Digitrip RMS Trip Unit. The adapter box should fit flush against the trip unit body.

4. Install the 2 screws and star washers into the rear of the adapter box to fasten it to the trip unit. The screws will fit into the threaded inserts of the spacers previously installed.

5. All Digitrip RMS 500 Trip Units have Zone Interlock capability for Short-Time and Ground Fault Delay functions. This zone interlock capability is defeated by two jumpers installed on the pc card in the adapter box as shown in Fig. 2-2. In most cases, the breaker to be retrofitted will not be employed in a zone interlock scheme and the jumpers will be left intact. However, if the breaker is employed in a short-time delay or ground fault time delay function, these jumpers should be removed as required to match the existing zone interlock scheme. Fig. 2-3 shows the correct jumper to be removed (by cutting) for short-time and ground fault delay functions.

**Note:** Removal of the jumpers will cause the breaker to trip instantaneously on short-time or ground fault delay functions.

#### 2-4. Installing the Digitrip RMS 500 Trip Unit Assembly and Rating Plug-in the SPB Breaker

1. Fig. 2-3 shows the breaker ready to receive the new trip unit assembly. Plug the Digitrip RMS Trip Unit Assembly, held in upright position, into the SPB Breaker trip unit plug-in terminal block. The holes in the adapter box should clear the trip unit guide pins and rating plug interlock trip bar. The trip unit edge-card must seat completely and properly in the terminal block. Then engage the upper and lower spring retention clips.

2. Install the rating plug by opening the snap down cover, pushing the Digitrip RMS Rating Plug into the Digitrip RMS Trip Unit receptacle, and tightening the screw into the breaker receptacle.

**Note:** The trip unit edge-card connector must seat properly in the trip plug-in terminal block before the rating plug is installed.

3. Install the breaker front cover and the manual charging handle.

#### 2-5. Circuit Breaker Checkout and Test

Before the breaker is placed into service, the new trip system must be checked out and tested. Perform several manual close and overcurrent trip operations, resetting the trip unit after each trip operation. See Section 3 for additional information on testing.

1. Verify the trip unit is in calibration by selecting and testing several trip points (as applicable) on the Long Delay, Short Delay, Instantaneous, and Ground Fault Time portions of the Digitrip RMS trip curve.

2. Select and set the proper user-determined overcurrent trip settings for the Digitrip RMS Trip Unit. Record the trip unit settings for permanent record and future reference.

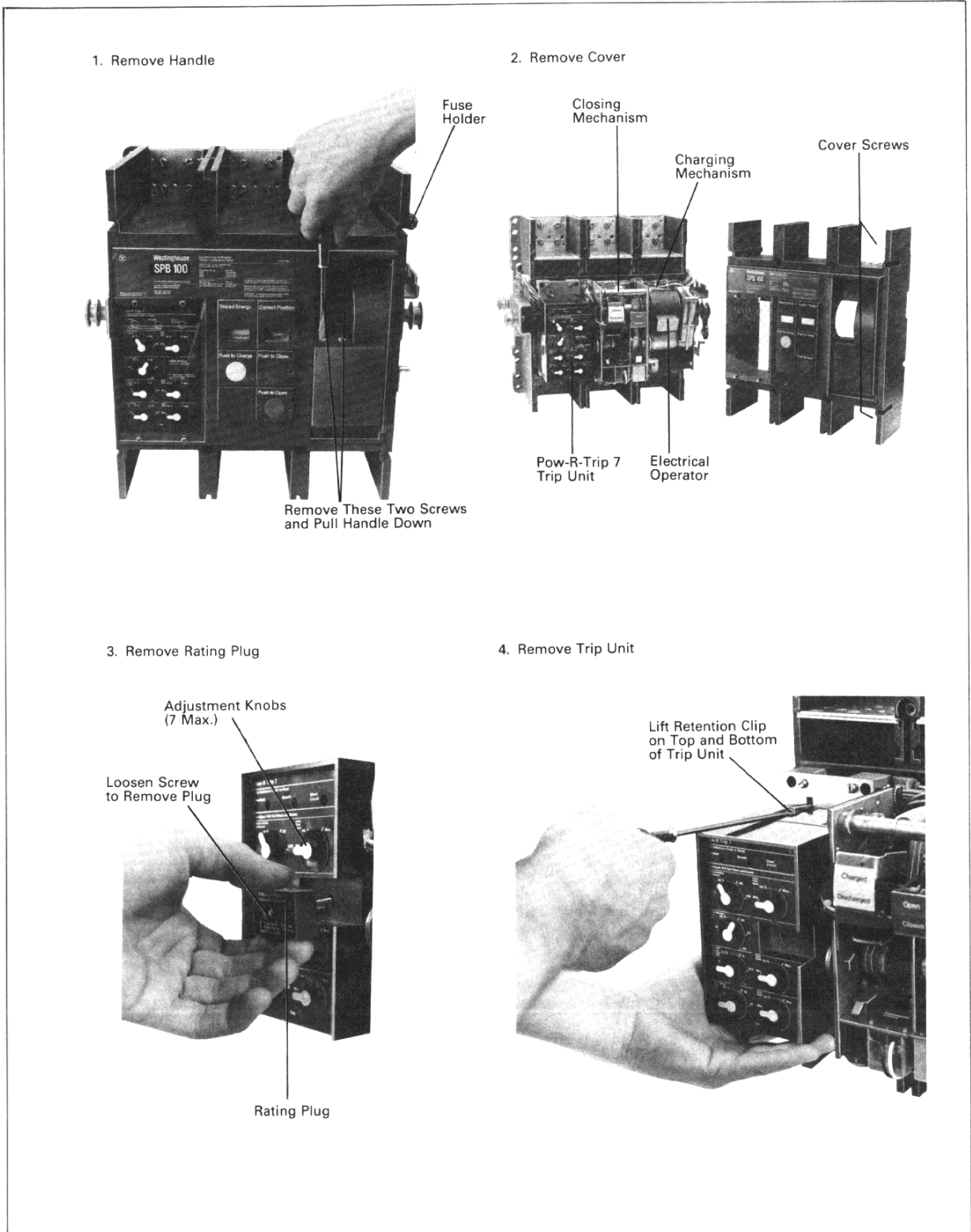


Fig. 2-1. Removal of the Existing Trip Unit and Rating Plug

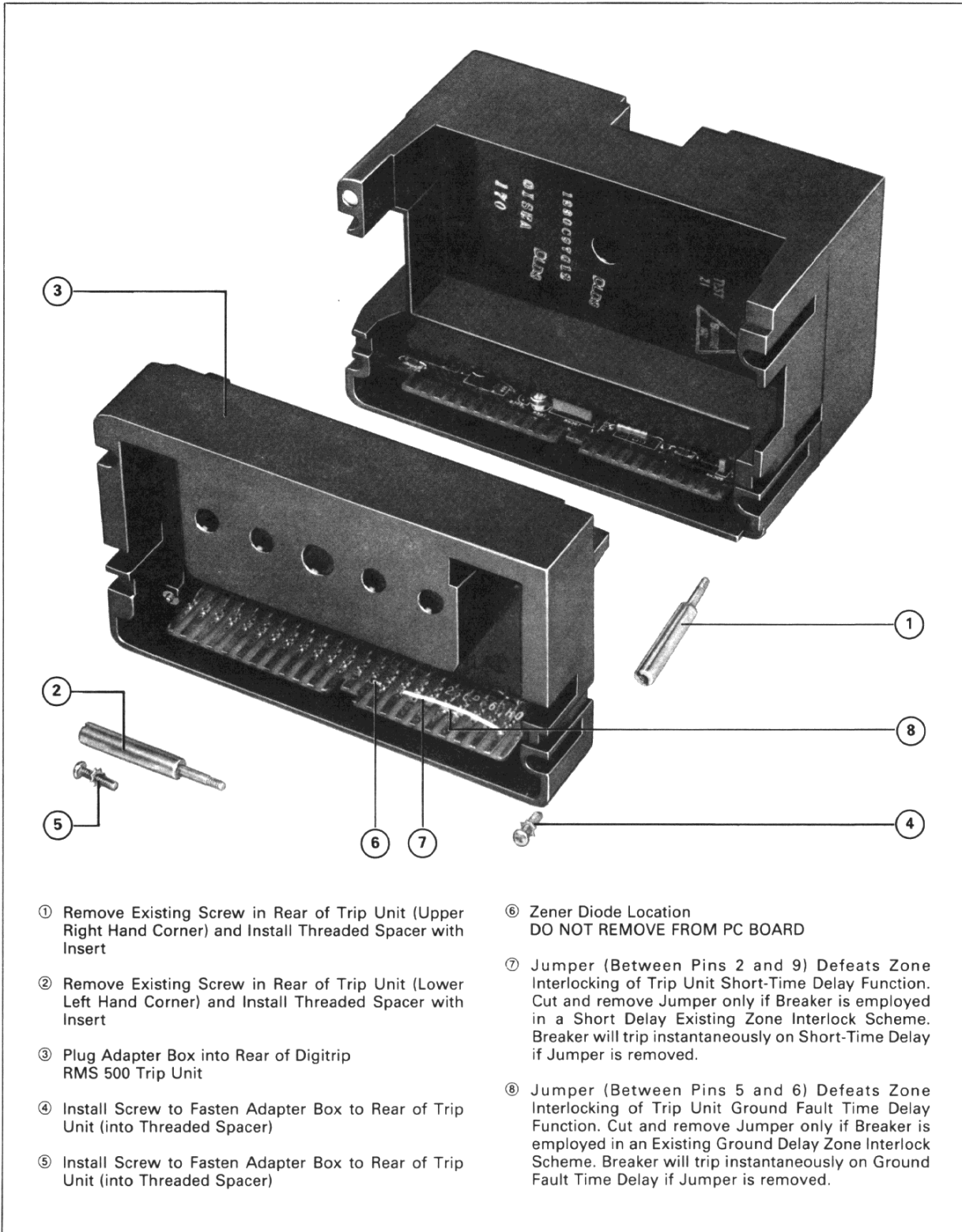


Fig. 2-2. SPB Adapter Box and Mounting Hardware (Rear View)

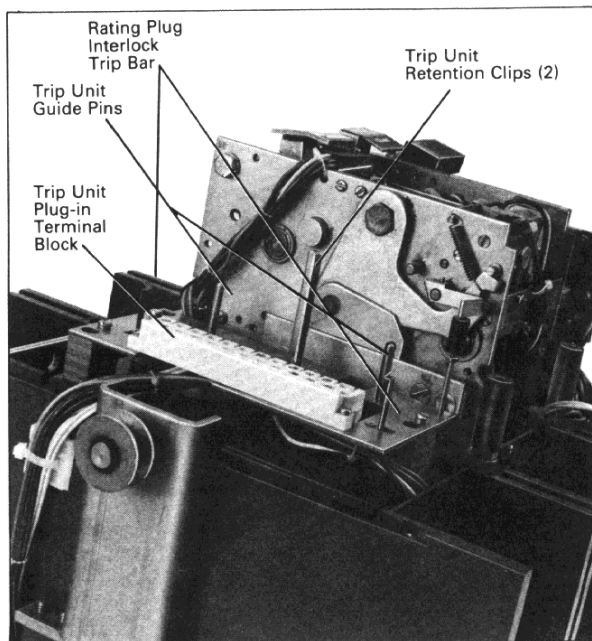


Fig. 2-3. SPB Breaker Ready to Receive Digitrip RMS Trip Unit Assembly

### Section 3

#### Testing of the Digitrip RMS Trip System

The Digitrip RMS overcurrent trip system may be tested by using the Digitrip RMS Self-Test System or primary injection testing equipment (e.g., Multi-Amp or EIL).

##### General Notes on Testing:

1. Digitrip RMS has a memory circuit that simulates the time required to cool down of overloaded conductors. When performing repeated Long Delay Trip tests, the results may be erroneous as the memory circuit must discharge prior to the next test. The memory circuit can be discharged by disconnecting the Auxiliary Power Module from the trip unit between tests or by waiting several minutes between tests.
2. Trip Unit Short Delay and Ground Fault Time trip functions will trip instantaneously, unless the zone interlocks functions are defeated by the jumpers provided in the adapter box. These jumpers are removed (if required) to match the existing breaker zone interlocking scheme of the breaker installation.

##### 3-1. Digitrip RMS Self-Testing System

###### **CAUTION**

USE OF THE DIGITRIP RMS SELF-TEST SYSTEM IS NOT RECOMMENDED WHILE THE BREAKER IS IN SERVICE IN THE SWITCHGEAR CELL COMPARTMENT. THE TRIPPING ACTION OF THE CIRCUIT BREAKER WILL CAUSE DISRUPTION OF SERVICE AND POSSIBLE PERSONAL INJURY INCLUDING DEATH AND POSSIBLE EQUIPMENT DAMAGE RESULTING

FROM UNNECESSARY SWITCHING OF CONNECTED EQUIPMENT.

Digitrip RMS Trip Units are equipped with self-testing capability. The self-testing system requires an optional accessory called the Auxiliary Power Module (APM) to operate. The APM plugs into the trip unit test receptacle and provides 32 Vdc to the trip unit from a 120 Vac 50/60 Hz circuit.

Once the self-test system is powered, the trip unit can be enabled to simulate set test conditions. The test amp settings are 1, 2, 3, 6T, 8, 10, GFT and GF  $I_n$  ratings. The trip unit will trip the breaker when the 6T and GFT settings are selected. The test is started by pushing the TEST pushbutton. The trip unit will test the trip unit depending on the test and time overcurrent settings selected, lighting the mode of trip LEDs. Be sure to push the TRIP RESET pushbutton to reset the trip unit and the LEDs when testing is complete, or you may burn out the rating plug battery.

##### 3-2. Primary Injection Testing

Primary injection testing is a useful alternative to the self-test method. Primary injection verifies the complete breaker overcurrent protection system, including the current sensors, rating plug, trip unit, and the interconnecting wiring. It involves the use of a tester, e.g., Multi-Amp Tester or EIL, to inject single phase primary current through the breaker to test the Digitrip RMS overcurrent trip system. For additional instructions on Field Testing of SPB Breaker, refer to Westinghouse I.L. 15094.

## Section 4

### Maintenance, Warranty, and Additional Information

#### 4-1. Maintenance

Establishment of a periodic preventative maintenance program is essential to assure breaker and switchgear reliability and integrity. Periodic maintenance, including testing, inspection, adjustment, and repair should be performed on both the circuit breaker and the switchgear assembly. For normal operating conditions, a minimum periodic interval of 12 months is recommended. However, additional factors, such as equipment age, state of repair, general condition, local operating environment, number of annual cycles, etc. must be considered in determining an effective maintenance interval.

Installation of a Digitrip RMS 500 Retrofit on an existing SPB circuit breaker does not alleviate the user from maintaining the circuit breaker in good operating condition. The Digitrip RMS Trip System will greatly enhance the capability of the circuit breaker to reliably and accurately detect and initiate a trip in the event of an overcurrent condition or fault. However, the ability of the breaker to trip and clear the fault is directly dependent on the operating condition of the breaker.

The user should continue to follow the applicable instructions and procedures provided in I.B. 15082.

#### 4-2. Warranty Procedure

Digitrip RMS Retrofit Kits include a limited warranty for components for 1 year from the date of shipment. Digitrip RMS Trip Units are factory sealed and are not field serviceable. Breaking the factory seal, opening the trip unit, and tampering with its internal components will void any warranty. In the

event of a problem with the trip unit, contact your local Westinghouse representative and provide the following information:

1. Original order number by which the kit component was purchased.
2. Part description.
3. Part catalog and/or style number.
4. Complete description of the problem.

If the problem is covered under warranty, instructions will be provided for obtaining a component replacement or for returning the component for repair.

#### 4-3. Additional Information

The listed documents contain applicable information for your Digitrip RMS Retrofit Kit Installation on SPB Breakers:

I.B. 15082	Instructions for the Systems Pow-R-Breaker and Drawout Mechanism 250, 800, 2000, 2500, 3000 amp frames.
I.B. 15094	Instructions for Field Testing of Systems Pow-R-Breakers.
I.L. 29-855-A	Digitrip RMS Trip Units Used with Type SPB Systems Pow-R-Breakers
I.L. 29-851-A	Instructions for the Digitrip RMS 500 Trip Unit.
RPD 29-890	Renewal Parts Data Systems Pow-R-Breakers.